

CLAIMS

What is claimed is:

- 1 1. A hydraulic system for use in a hydrostatic transmission comprising in  
2 combination:
  - 3 a variable displacement main pump;
  - 4 a hydraulic motor;
  - 5 a hydraulic circuit operatively interconnecting said main pump and said motor  
6 including a first line connecting a first port within said main pump to a first port within  
7 said hydraulic motor and a second line connecting a second port within said main pump  
8 to a second port within said hydraulic motor;
  - 9 a charge pump operatively connected to said circuit and a reservoir; and
  - 10 wherein said variable displacement pump has:
    - 11 a first input passage fluidly connected to said hydraulic circuit first line;
    - 12 a second input passage fluidly connected to said hydraulic circuit second  
13 line;
    - 14 an output passage fluidly connected to a pump case drain line that leads to  
15 said reservoir;
    - 16 a valve bore integrated within said pump in fluid communication with said  
17 first input passage, said second input passage and said output passage, for  
18 receiving a hot oil shuttle valve;
    - 19 said hot oil shuttle valve including a valve spool, adapted for sealing movement  
20 within said spool bore, having a first end portion, a second end portion, and a connecting  
21 portion having a cross sectional area smaller than that of the first and second end portions  
22 and in fluid communication with at least a portion of said output passage at all times, said  
23 valve spool being longitudinally movable, via fluid pressure, within said spool bore from

24 a neutral position to one of a first and second position, wherein the fluid pressure forces,  
25 acting on the first and second end portions, are approximately equal in said valve spool  
26 neutral position, the fluid pressure forces acting on said first end portion being greater  
27 than the fluid pressure forces acting on said second end portion in the first position, and  
28 the fluid pressure forces acting on said first end portion being less than the fluid pressure  
29 forces acting on said second end portion in the second position, said second input passage  
30 communicating hot oil fluid to said output passage while said valve spool is in said first  
31 position and said first input passage communicating hot oil fluid to said output passage  
32 while said valve spool is in said second position.

1 2. A hydraulic system for use in a hydrostatic transmission comprising in  
2 combination:

3 a main pump;  
4 a hydraulic motor;  
5 a hydraulic circuit operatively interconnecting said main pump and  
6 said motor including a first line connecting a first port within said main  
7 pump to a first port within said hydraulic motor and a second line  
8 connecting a second port within said main pump to a second port within  
9 said hydraulic motor;

10 a charge pump operatively connected to said circuit and a reservoir;  
11 and

12 wherein an improvement comprises said variable displacement  
13 pump having an integrated hot oil shuttle valve for diverting a portion of  
14 fluid flowing through said hydraulic circuit to said reservoir.

1 3. The hydraulic system in claim 2 wherein said main pump is a variable  
2 displacement pump.

1    4.     The hydraulic system in claim 3 wherein said hot oil shuttle valve diverts fluid  
2    from said second line to said reservoir when the pressure in said first line is greater than  
3    the pressure in said second line and diverts fluid from said first line to said reservoir when  
4    the pressure in said first line is less than the pressure in said second line.

1    5.     The hydraulic system in claim 3 wherein said pump has a case with at least one  
2    orifice for connection with a case drain line.

1    6.     The hydraulic system in claim 3 wherein said motor is a two-stage motor.

1    7.     The hydraulic system in claim 3 wherein said hot oil shuttle valve takes the form  
2    of a spool valve.

1    8.     A hydraulic pump for a closed-loop hydrostatic transmission circuit having an  
2    integrated shuttle valve for diverting hot fluid from said hydrostatic transmission circuit  
3    to a reservoir, said circuit operatively interconnecting said hydraulic pump with a motor.

1    9.     The hydraulic pump as in claim 8 wherein said circuit includes a first line  
2    connecting a first port within said hydraulic pump to a first port within said motor and a  
3    second line connecting a second port within said hydraulic pump to a second port within  
4    said motor.

1    10.    The hydraulic pump in claim 9 wherein said shuttle valve is housed within a bore  
2    in said pump, said bore is fluidly connected to a first passage, a second passage and a  
3    third passage, said first passage is fluidly connected to said first line in said closed-loop  
4    hydrostatic transmission circuit, said second passage is fluidly connected to said second  
5    line in said closed-loop hydrostatic transmission circuit, said third passage is fluidly

6 connected to a case drain line connecting said pump to said reservoir, said first passage  
7 has fluid flow therethrough when the pressure in said first line is less than the pressure in  
8 said second line, said second passage has fluid flow therethrough when the pressure in  
9 said second line is less than the pressure in said first line, said third line has fluid flow  
10 therethrough when either the pressures in said first and second lines are not equal.

1 11. The hydraulic pump in claim 9 wherein said shuttle valve is housed within a bore  
2 in said pump and can reciprocatingly move from a centered position, in which the  
3 pressure in said first line is equal to the pressure in said second line, to a first position, in  
4 which the pressure in said first line is greater than the pressure in said second line, and a  
5 second position, in which the pressure in said first line is less than the pressure in said  
6 second line.

1 12. The hydraulic pump as in claim 11 wherein the hot fluid passes from said second  
2 line to said reservoir for cooling when said shuttle valve is in said first position and the  
3 hot fluid passes from said first line to said reservoir for cooling when said shuttle valve is  
4 in said second position.

1 13. The hydraulic pump as in claim 8 wherein said motor is a two-pressure stage  
2 motor

1 14. The hydraulic pump as in claim 8 wherein said hydraulic pump is a variable  
2 displacement pump.